

Digital Elevation Models of Alabama and Northwest Florida Coast: Procedures, Data Sources, and Analysis

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Summary

In September of 2019, NOAA's National Centers for Environmental Information (NCEI) developed integrated bathymetric-topographic digital elevation models (DEMs) according to specifications developed jointly by NOAA NCEI and the United States Geological Survey (USGS) to help better define a consistent elevation mapping framework for the nation (Table 1). Overall, 75 tiled DEMs were created in the area of interest: 56 tiles were created at the highest resolution of 1/9 arc-second, 19 were created at a resolution of 1/3 arc-second. Only 1/9 arc-second DEM tiles integrate topography and bathymetry. The DEM tiles represent best publicly-available data at the time of their creation; the intent is to update specific tiles as new source data becomes available. The utilization of a tiling scheme in developing the DEMs is intended to improve data management during source data processing as well as facilitate targeted DEM updates.

The tiled DEMs cover the Alabama and northwest (NW) Florida coasts including Mobile Bay, Alabama and portions of the Florida coast west of Apalachee Bay near Tallahassee. The extents of these DEMs, procedures, data sources, and analysis are described below. The methodologies used by NCEI in developing DEMs are described in the NOAA National Centers for Environmental Information Topo-Bathymetric Digital Elevation Models: East Florida (Amante, 2018).

Table 1. Specifications for the DEM tiles.

<i>Grid Area</i>	<i>Alabama and NW Florida Coast</i>
Coverage Area	88.50° to 84.00° W, 29.25° to 31.50° N
Coordinate System	Geographic decimal degrees
Horizontal Datum	NAD 83
Vertical Datum	NAVD 88
Vertical Units	Meters
Cell Size	Variable (1/9 th or 1/3 rd Arc-Second)
Grid Format	Geotiff

DEM Specifications

The Alabama and NW Florida tiled DEMs were built to the specifications listed in Table 1. Figure 1 shows the 1/9 arc-second DEM tile boundaries in orange and the 1/3 arc-second DEM tile boundaries in green.

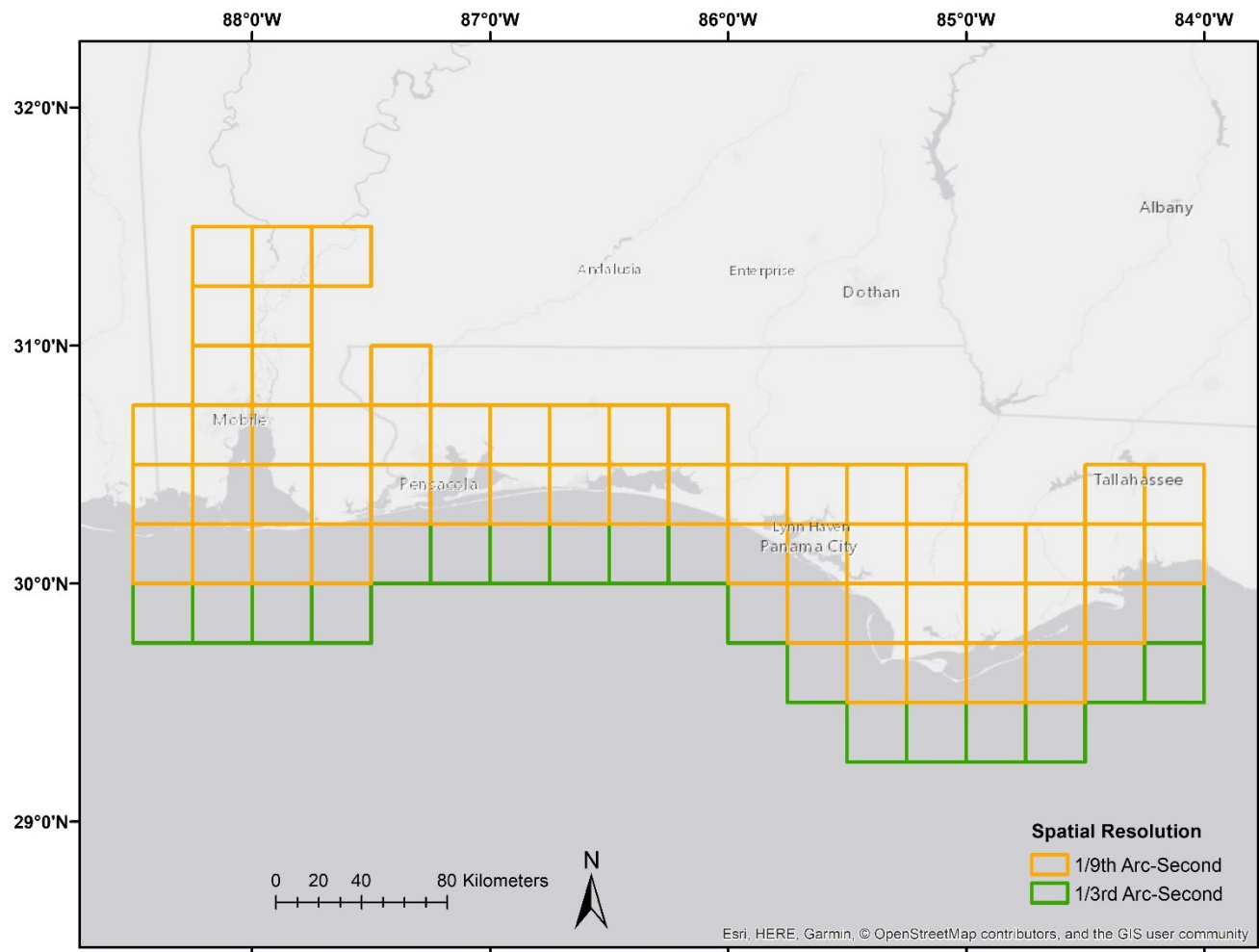


Figure 1. Map image of the DEM tile boundaries for the Alabama and NW Florida Coast DEMs.

Data Sources and Processing

Bathymetry data used in the generation of the Alabama and NW Florida Coast DEMs included NOAA National Ocean Service (NOS) hydrographic surveys and bathymetric attributed grids (BAGs), NCEI multibeam survey data, and the U.S. Army Corps of Engineers (USACE) channel condition surveys (Table 2).

Table 2: Bathymetric data sources used in DEM development.

Source	Date	Data Type	Spatial Resolution	Horizontal Datum	Vertical Datum
NOAA NOS	1872 to 2018	Hydrographic survey soundings	< 10 meters to several kilometers	NAD 83 geographic	Mean Lower Low Water (MLLW)
NCEI	1989 to 2018	Multibeam Bathymetric Surveys	~1 to 10 meters	NAD 83 geographic	Assumed Instantaneous Water Level
NOAA NOS BAG	2005 to 2018	Hydrographic survey soundings	0.5 to 8 meters	NAD 83 geographic	MLLW
USACE	1999 to 2019	Hydrographic channel condition surveys	~1 to 10 meters	NAD 83 geographic	MLLW

Bathymetric data were transformed to NAVD88 and where more recent, higher resolution data existed, older data were edited or superseded. Vertical datum transformations were performed using NOAA's VDatum Software.

Bathymetric-topographic data used in developing the Alabama and NW Florida Coast DEMs included bathymetric-topographic lidar from NOAA National Geodetic Survey (NGS) and USACE (Table 3).

Table 3: Bathymetric-Topographic data sources used in DEM development.

Source	Date	Data Type	Spatial Resolution	Horizontal Datum	Vertical Datum
USACE NCMP Topobathy Lidar: Florida Gulf Coast	2015	Bathymetric-Topographic Lidar	Variable	NAD 83 geographic	NAVD88
USACE NCMP Topobathy Lidar: Gulf Coast (AL, FL, MS, TX)	2016	Bathymetric-Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NOAA NGS Topobathy Lidar: St Joe (FL)	2016	Bathymetric-Topographic Lidar	Variable	NAD 83 geographic	NAVD88
USACE FWC Topobathy Lidar : Santa Rosa Sound (FL)	2017	Bathymetric-Topographic Lidar	Variable	NAD 83 geographic	NAVD88
USACE FEMA Post-Michael Topobathy Lidar: Florida Panhandle	2018	Bathymetric-Topographic Lidar	Variable	NAD 83 geographic	NAVD88

USACE NCMP Topobathy Lidar: Gulf Coast (AL, MS)	2018	Bathymetric- Topographic Lidar	Variable	NAD 83 geographic	NAVD88
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Topographic data used in developing the Alabama and NW Florida Coast DEMs included lidar data from the Northwest Florida Water Management District (NFWFMD), Florida Division of Emergency Management (FDEM), USGS, County of Mobile Alabama, Mississippi Department of Environmental Quality (MDEQ), NOAA Office of Coastal Management (OCM), County of Escambia Alabama, and NOAA NCEI (Table 4).

Table 4: Topographic data sources used in DEM development.

Source	Date	Data Type	Spatial Resolution	Horizontal Datum	Vertical Datum
NFWFMD Lidar: Escambia, Santa Rosa, & Walton Counties	2006	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NFWFMD Lidar: Northern Jefferson County	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
FDEM Lidar: Coastal Jefferson County	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
FDEM Lidar: Coastal Okaloosa County	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
FDEM Lidar: Franklin County	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
FDEM Lidar: Wakulla	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NFWFMD Lidar: 5 Counties	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NFWFMD Lidar: Apalachicola River	2007	Topographic Lidar	Variable	UTM Zone 16 North, NAD83	NAVD88
NFWFMD Lidar: Bay, Calhoun, Jackson & Washington Counties	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NFWFMD Lidar: Gadsden County	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
FDEM Lidar:	2007	Topographic Lidar	Variable	NAD 83 geographic	NAVD88

Gulf County					
NWFWMD Lidar: Inland Okaloosa County	2008	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NWFWMD Lidar: Walton County (Eglin AFB)	2008	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NCEI Mobile Bay, AL DEM	2009	DEM	1/3 arc-second	NAD 83 geographic	NAVD88
NWFWMD Lidar: Leon County	2010	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NWFWMD Lidar: Liberty and Calhoun Counties	2010	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
USGS Lidar: Mobile Bay (AL)	2010	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
USGS Lidar: Baldwin County, AL	2011	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
Lidar: Escambia, AL	2013	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
USGS CONED Mobile Bay, AL DEM	2013	DEM	1/9 arc-second	NAD 83 geographic	NAVD88
Lidar: Mobile County, AL	2014	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
MDEQ Lidar: MS Coastal QL2	2015	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
USGS Lidar: Tishomingo, MS	2016	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
USGS NED DEM	2016	DEM	1/3 arc-second	NAD 83 geographic	NAVD88
NWFWMD Lidar: Escambia Santa Rosa	2017	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
NWFWMD Lidar: Lower Choctawhatche	2017	Topographic Lidar	Variable	NAD 83 geographic	NAVD88
OCM Unmanned Aerial Systems Lidar: Grand Bay NERR	2017	Topographic Lidar	Variable	NAD 83 geographic	NAVD88

DEM Development

Development of the Alabama and NW Florida Coast DEM tiles followed procedures documented in NOAA National Centers for Environmental Information Topo-Bathymetric Digital Elevation Models: East Florida (Amante, 2018). Exceptions being that the bathymetric pre-surface was generated at 1 arc-second due to the coarse resolution of offshore bathymetric data, and gridding weights were modified as shown in Table 5. The bathymetric pre-surface derived from data sources in Tables 2 and 3 was converted to XYZ and was utilized in the final DEM creation. Older, coarse, and/or inaccurate bathymetric surveys from NOAA NOS Hydrographic Surveys and NCEI multibeam surveys were used in the bathymetric pre-surface but were not used as source datasets in the final DEM creation with MB-System's 'mbgrid.'

Table 5: Data hierarchy used to assign gridding weights in MB-System's 'mbgrid.'

<i>Dataset</i>	<i>Relative Gridding Weight</i>
NOAA NOS BAG	1
USACE Channel Condition Surveys	1
USACE NCMP Topobathy Lidar: Florida Gulf Coast	1
USACE NCMP Topobathy Lidar: Gulf Coast (AL, FL, MS, TX)	1
NOAA NGS Topobathy Lidar: St Joe (FL)	1
USACE FWC Topobathy Lidar : Santa Rosa Sound (FL)	1
USACE FEMA Post-Michael Topobathy Lidar: Florida Panhandle	1
USACE NCMP Topobathy Lidar: Gulf Coast (AL, MS)	1
NWFWMD Lidar: Escambia, Santa Rosa, & Walton Counties	1
NWFWMD Lidar: Northern Jefferson County	1
FDEM Lidar: Coastal Jefferson County	1
FDEM Lidar: Coastal Okaloosa County	1
FDEM Lidar: Franklin County	1
FDEM Lidar: Wakulla	1
NWFWMD Lidar: 5 Counties	1
NWFWMD Lidar: Apalachicola River	1
NWFWMD Lidar: Bay, Calhoun, Jackson & Washington Counties	1
NWFWMD Lidar: Gadsden County	1

FDEM Lidar: Gulf County	1
NWFWMD Lidar: Inland Okaloosa County	1
NWFWMD Lidar: Walton County (Eglin AFB)	1
NCEI Mobile Bay, AL DEM	1
NWFWMD Lidar: Leon County	1
NWFWMD Lidar: Liberty and Calhoun Counties	1
USGS Lidar: Mobile Bay (AL)	1
USGS Lidar: Baldwin County, AL	1
Lidar: Escambia, AL	1
USGS CONED Mobile Bay, AL DEM	1
Lidar: Mobile County, AL	1
MDEQ Lidar: MS Coastal QL2	1
USGS Lidar: Tishomingo, MS	1
USGS NED	1
NWFWMD Lidar: Escambia Santa Rosa	1
NWFWMD Lidar: Lower Choctawhatchee	1
OCM Unmanned Aerial Systems Lidar: Grand Bay NERR	1
USGS CONED Mobile Bay DEM	0.001
NCEI Mobile Bay DEM	0.0001
USGS NED DEM	0.00001
Bathymetric pre-surface	0.00001

DEM Analysis

Once the Alabama and NW Florida Coast DEMs were generated, the DEMs were compared to the high-resolution source elevation data and high-resolution imagery. Inconsistencies were evaluated and resolved based on the most reliable data available. The largest outstanding issue with the DEM tiles is the lack of publicly-available lidar datasets for areas north of Mobile Bay. In such areas, older, coarser-resolution, topographic data were used from a previously developed NCEI DEM (Mobile Bay, AL) and the USGS CONED (Mobile Bay, AL) and NED DEMs. When higher resolution publicly available data becomes available for these areas, these DEM tiles will be updated with more accurate, detailed elevation information.

Reference

C.J. Amante (2018) NOAA National Centers for Environmental Information Topo-Bathymetric Digital Elevation Models: East Florida, NOAA, pp. 6.